waste chips. Nos. 1–8 and 11 are such supposable instances. Both parts of No. 8 were picked up. Few entire or finished implements occur, as they would not be left in these places unless lost. Nos. 9 and 10 are complete; Nos. 12–14, roughly chipped and supposably unfinished.

Proximity to the supply of chert has doubtless determined this common occurrence of chippings in the sandy stretches near the lake. There is no evidence at hand of greater antiquity than the Indian.

W. A. PHILLIPS.

Evanston, Ill., Feb. 15.

Illusive memory.

For some time past, I have been investigating a curious psychical or psycho-pathological experience which is alluded to by many writers upon psychology, and is not infrequently met with in general literature. It is that vague sentiment of familiarity we sometimes have upon entering a new experience, best expressed in the words, 'I have seen or known all this before.' It has been explained by various writers, upon two widely different theories. The first is, that this 'double perception,' 'double thinking,' 'double presentation,' as it has been variously named, arises from the dual structure of the brain, resulting in cases of imperfectly correlated action in two images or impressions not absolutely simultaneous: the latter, therefore, is a repetition of the former, and gives rise to a sentiment that it has passed through the mind at some indefinite previous time. This theory, it will be observed, is a physiological one. The other theory is, that the phenomenon is a purely psychical one; that the false or illusory memory (Erinnerungstäuschung, Sander) has a real basis in some actual past presentation which is identical, or closely similar, with the present one; or in some past images of the waking imagination, or dream-life, that, although these cannot be recalled into consciousness, they are sufficient to give us the conviction that the present event is the repetition of a former one — why, or how, we do not know. There are several cases upon record, where this sentiment has assumed a pathological character, and become a continual delusion, attending every experience.

Two years ago, in the hope of obtaining more information, I distributed a question upon the subject among a large number of persons, principally college-students. It may now be given in somewhat amplified form, as follows: —

Have you come suddenly upon an entirely new scene, and, while certain of its novelty, felt inwardly that you had seen it before — with a conviction that you were revisiting a dimly familiar locality? Mention, if you can, an instance or two in which this has occurred. Has any satisfactory explanation of this experience ever suggested itself to you? How frequent is the experience in your case? Was it more frequent in childhood than at present? How soon do you usually become conscious of the deception? Does it occur more frequently in connection with some kinds of experience than with others?

A quantity of material upon this subject has already been collected in this and other ways, which I hope to publish in a review article in April. In the mean while, any information bearing upon this question will be of great assistance and value to me.

HENRY F. OSBORN.

Princeton, N.Y., Feb. 23.

Ripple-marks in limestone.

The alternating limestones, shales, and sandstones of the upper coal-measures of Kansas are well exposed along the ridges and water-courses near Eureka. Some of the limestone is thin-bedded, apparently due to interlaminated sheets of argillaceous material. The layers of limestone, however, seem to contain little foreign matter, certainly not more than the Trenton limestones (Buff) of Wisconsin and Minnesota. The organic remains consist largely of crinoid columns, shells of brachiopods and lamellibranchs, and a few gastropod shells and cup corals. Nearly every layer of limestone shows these remains in great abundance firmly bound together by the highly crystalline matrix.

I have been thus particular in describing the limestone, that the conditions which made the following feature possible may be understood. Some six or eight slabs of this limestone in one of our sidewalks are clearly and distinctly ripple-marked. This is the first instance of the kind that has fallen under my observation during ten years of state and private work in nearly as many states of the Union.

The occurrence of ripple-marks in calcareous mud containing the remains of deep-sea, clear-water animals, and interlaminated with argillaceous mud, is a combination not quite in accordance with the teachings of our text-books in geology.

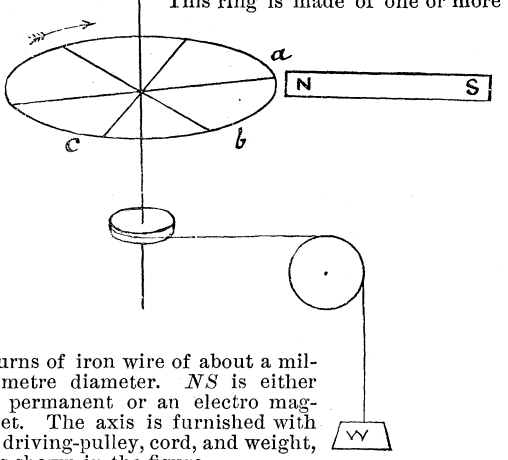
L. C. WOOSTER.

Eureka, Kan., Feb. 23.

A novel magnetic engine.

It is a well-known fact that iron, when heated to a red heat, ceases to be magnetic; so that an armature, after being heated to redness, may be removed from its magnet by the expenditure of only a small fraction of the energy which is developed by the attraction of the same armature when it has cooled.

Manifestly this fact might be employed in the construction of a motor, which, while of no practical value, is of theoretical interest, in which a permanent magnet should act as the direct motive force. This has been done in the following manner. In the figure, *a b c* represents a ring thirteen centimetres in diameter, and supported horizontally upon radial arms and an axis of some non-magnetic metal. This ring is made of one or more



turns of iron wire of about a millimetre diameter. *NS* is either a permanent or an electro magnet. The axis is furnished with a driving-pulley, cord, and weight, as shown in the figure.

That part of the ring which lies between *a* and *c* is heated to bright redness by means of two or three Bunsen burners. The magnet then exerts a preponderating attraction upon the farther or cool side of the ring, and the latter revolves as indicated by the

arrow. As fast as the ring enters the space $a\,b\,c$, it becomes red-hot and non-magnetic, and a lack of equilibrium is thus maintained which results in a continuous rotation.

The motion is necessarily quite slow on account of the considerable time required to heat the iron ring. In the actual experiment, moreover, considerable difficulty was experienced from the distortion which the ring underwent when softened by the heat, in consequence of which the speed of rotation became very irregular. With a permanent steel magnet, a speed of about one revolution in two minutes was obtained; and with a powerful electro-magnet, a weight of six grams was raised fifty centimetres in six minutes, and, in a second experiment (the ring having become quite distorted), ninety centimetres in thirty minutes.

Of course, the source of energy is the Bunsen burners; and the experiment leads at once to the fact, that the specific heat of magnetized iron is greater than that of unmagnetized. CHAS. K. MCGEE.

University of Michigan,
Ann Arbor, Feb. 19.

Congenital deafness in animals.

The communication of Professor Bell in No. 54 of *Science*, in reference to Mr. Lawson Tait's statement that no other animals than cats are affected with congenital deafness, calls to my mind the fact, that in my early boyhood I had a dog which was thus afflicted. I got him when a puppy; and, so far as we could determine, he was never able to distinguish any sounds. He was of the breed usually known as 'fist,' and, so far as my memory serves me, was of a yellow color: certainly he was not pure white. What renders this instance the more interesting, is the further fact, that a playmate of mine also had a deaf dog. I think he was of the same family, but not, I believe, of the same litter. That congenital deafness should be rare among wild animals, I can readily understand, since, in the struggle for existence, their defect would lead to an early extinction; but under domestication, where their conditions approach more nearly to those of man, I can see no reason why a defect of physical organization should not be transmitted by inheritance, as I believe it to have been in the cases above cited. It is a fact well known to aurists, that in some families there is a tendency to become hard of hearing, or even deaf, at about the same age; owing, doubtless, to certain evolutions which take place in their physical structure at that time. SWAN M. BURNETT, M.D.

Washington, Feb. 22.

A singular optical phenomenon.

The windows of our office are provided with fly-screens having the ordinary mesh of something less than an eighth of an inch. Thirty feet across the way is a building whose windows are protected by a coarse screen having a mesh a little less than half an inch in size. Standing about ten feet back from and looking through the fly-screen at the coarse screen, an inverted, magnified image of the latter is seen in mid-air, between the observer and the fly-screen; the inversion, of course, being only detected by the apparent movement made by the image on changing the position of the eyes. The explanation of the phenomenon is not difficult. The lines of the coarse screen throw nominally a single ray of light, which is inverted through the particular mesh of the fly-screen directly in line with it and the observer. Any other substance, such as a paper wad introduced in the coarse screen, will not appear in the image. It may not be uninteresting to mention in this connection the fact, that while a short-sighted person, to whom I endeavored to show the same phenomenon in my home, using as an object the slats of a blind in a house a hundred and fifty feet away, was unable to see the actual slats, owing to their remoteness, their image was distinctly visible to her. F. J. S.

Deflective effect of the earth's rotation.

In a letter of mine, published in *Science*, ii. No. 26, I suggested that the deflecting force produced by the rotation of the earth on bodies moving on its surface is not wholly represented by the rotation of a tangent plane, but depends, in part, on the centrifugal force resulting from the body's relative motion in longitude, and is therefore greatest when the motion is perpendicular to the meridian.

That my suggestion is *not* true, and that the force is the *same* for all directions of the motion, may be demonstrated very simply, as follows:—

From the proposition announced in section 25 of Peirce's 'Analytical mechanics,' it follows that any tangent plane whose latitude is λ rotates about an axis normal to that plane with an angular velocity equal to ω cosec. λ, ω denoting the angular velocity of the earth about its polar axis.

Therefore if P represent the point where the normal axis pierces the surface of the sphere, and if a body be caused to move in any direction over the point P with a velocity v, it will, by the rotation of the tangent plane, be constrained to describe in space the spiral of Archimedes, whose equation is $u = a\theta$; and when $\theta = 2\pi$, $u = v$ multiplied by the time of one rotation of the tangent plane. Hence, if one hour be the unit of time, $u = 24\,v$ cosec. λ; and $\frac{1}{2}a$, = the radius of curvature at the origin of the spiral, $= 6\,v \div \pi \sin \lambda$.

Now, the deflecting force at P is equal to the centrifugal force due the velocity v at the origin of the spiral, which is represented by $v^2 \div \frac{1}{2}a$:

$$\therefore f = \tfrac{1}{6}\,v\,\pi \sin \lambda.$$

But the centrifugal force, $V^2 \div R$, due the rotation of the earth at the equator, is known to be $\frac{1}{289}mg$; mg denoting the weight of the body, and $V = \frac{1}{12}\pi R$:

$$\therefore f : \tfrac{1}{289}\,mg :: \tfrac{1}{6}\,v\,\pi \sin \lambda : V^2 \div R;$$

whence, substituting for V^2, we get,

$$f = \frac{\frac{1}{289}\,mg\,24\,v \sin \lambda}{\pi R}.$$

The centrifugal force resulting from the body's relative motion in longitude affects only the origin of the spiral, and not at all its elements, and hence has no influence on the value of f: consequently f is the total deflecting force, and is independent of the direction of the motion. J. E. HENDRICKS.

Des Moines, Io., Feb. 14.

A carboniferous genus of sharks still living.

I observe that in a late number of *Science*, Mr. Garman describes a new genus of sharks from the Japanese seas, under the name of Chlamydoselachus. The figure of the teeth which he gives shows the animal characterized by Mr. Garman to be a species of the genus Didymodus (Cope, Proceedings Philadelphia Academy, 1883, p. 108, equal to Diplodus Agass. Poiss. fossiles, pre-occupied in recent fishes), which has hitherto been supposed to be confined to the carboniferous and Permian periods. The species possess two, three, or four denticles. Material in my possession enables me to fix the position of this genus, which I will endeavor to explain in the next (April) number of the *American naturalist*. Didymodus